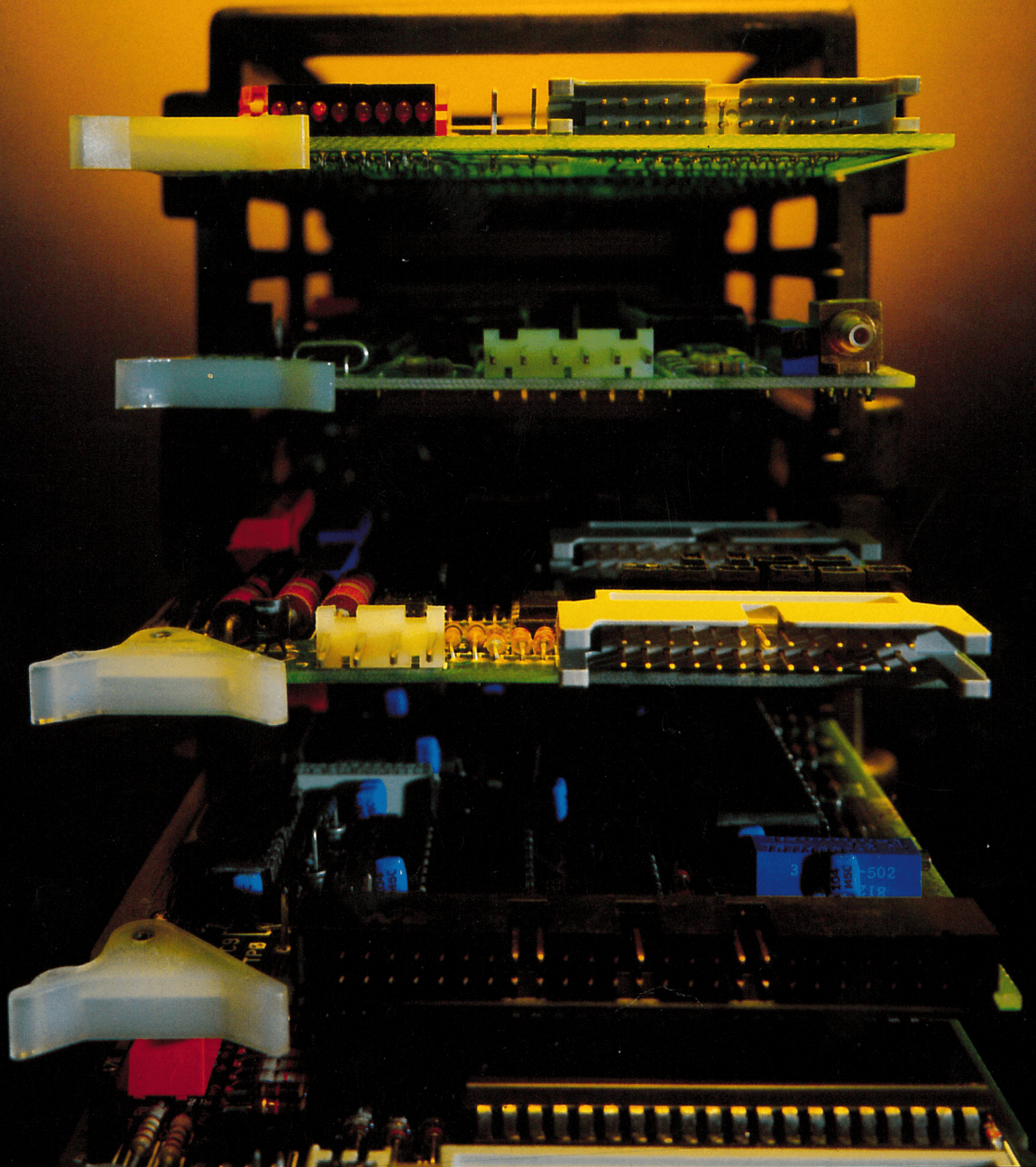


ROCKWELL RM 65
MICROCOMPUTER
MODULES



SPRINGBOARD TO NEW PROFIT OPPORTUNITIES.

RM 65 modules: The simple solution to designing intelligence into your products.

In the engineering world, there's a special advantage to designs that are *simple*; that meet all given specifications in the most direct, most reliable, yet least costly and least complicated way.

And that precisely describes the RM 65 family of microcomputer modules.

So when you're designing programmable, intelligent control or data collection capabilities into a product or system, consider the RM 65 family: standard, board-level modules that offer the easiest route to a simple, cost-effective product solution.

The building blocks in the RM 65 family let you piece together the exact hardware and software configuration that satisfies your need. Using RM 65 modules can help your solution achieve *simplicity* in several dimensions.

Shorter start-up times

One measure of simplicity is how little time and effort are needed between a project's inception and its completion. The RM 65 family helps shorten the time it takes to get your new product to market, or your control application on line.

Boards in the RM 65 family are known quantities—tested and documented both individually and in their interactions with each other. When you use RM 65 modules as the building blocks for your design, you're free to focus completely on adding the control benefits of RM 65 to your product. Since RM 65 boards are ready to plug together and run, you needn't worry about the internal workings of the intelligence itself. That means your project is finished faster and costs less to complete.

Minimized risks

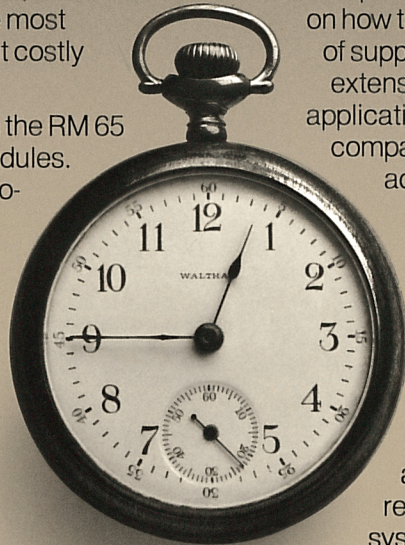
Because the RM 65 modules are known quantities, they also eliminate many risks enroute to getting your design up and running.

Since they're built around the widely used R6502 microprocessor, there is a deep pool of knowledge on how to make use of their capabilities. A wealth of support is available in applications notes and extensive documentation, backed by Rockwell application engineers and the resources of the company that has achieved numerous industrial advances. Designs built with RM 65 modules can not only be brought up faster than circuits designed from scratch, but with built-in quality—so they'll continue running longer.

Designed for efficiency

A microcomputer tailored to your requirements from RM 65 modules allows you to avoid waste that often results from trying to adapt a packaged system originally designed for somebody else's needs or for broad, "all-purpose" use.

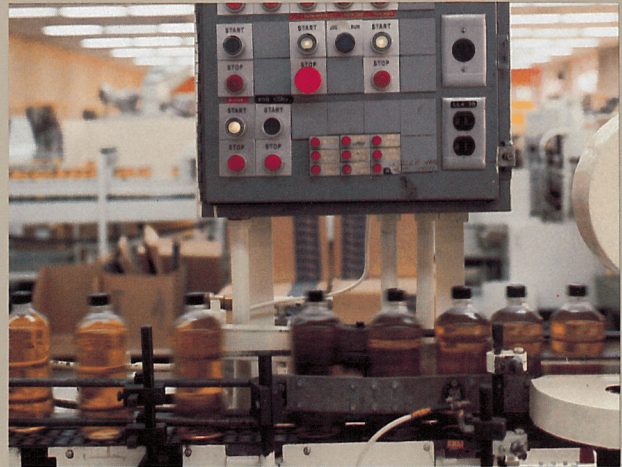
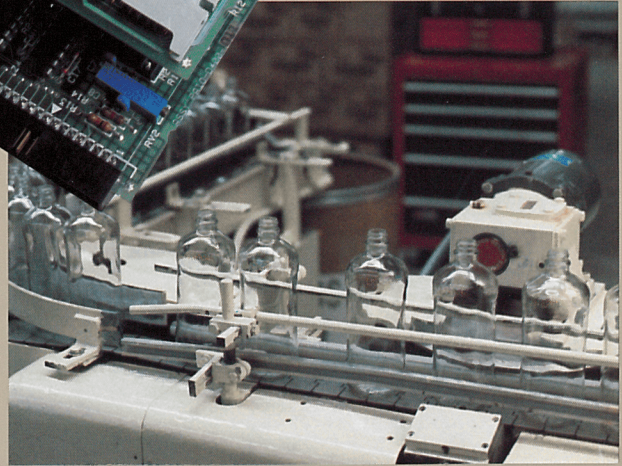
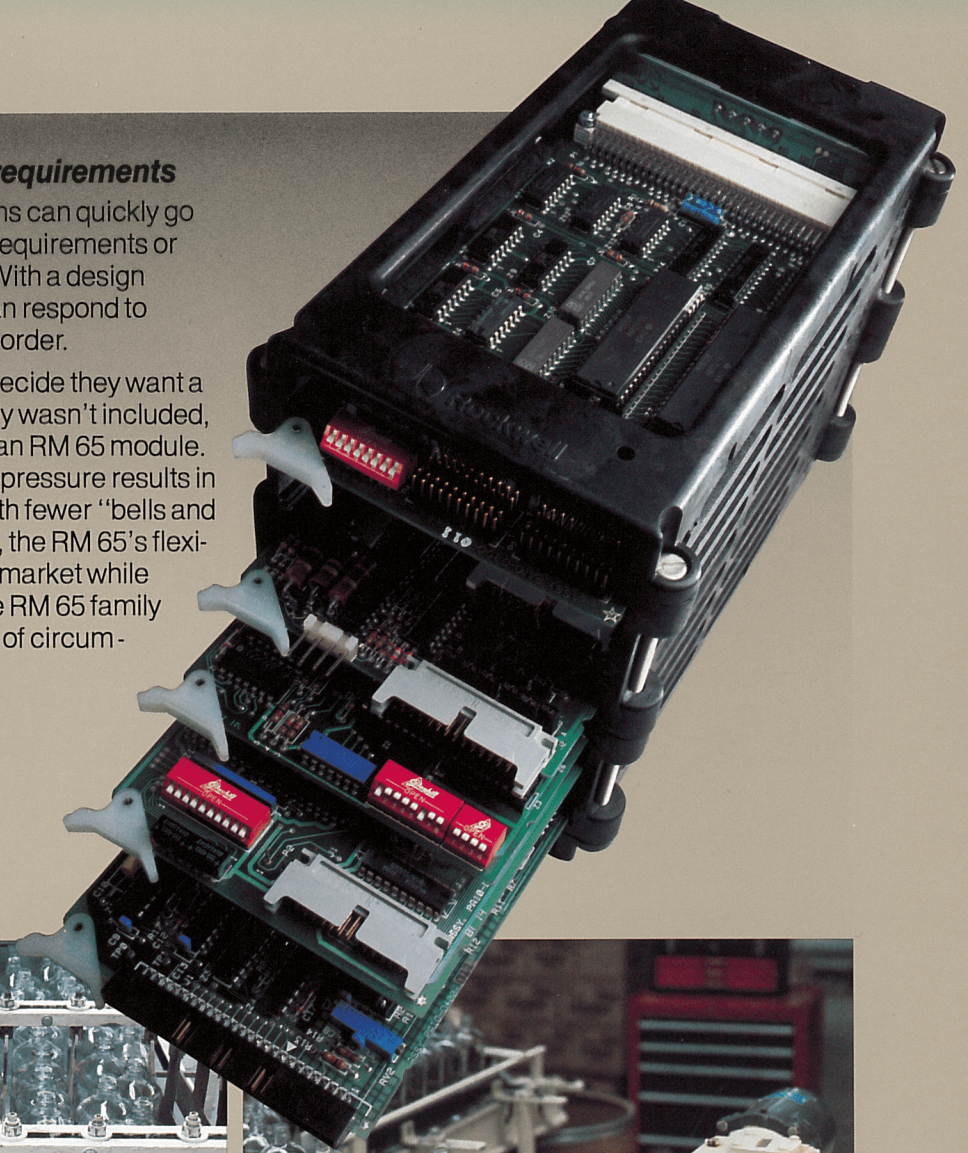
The savings are particularly significant in designs that will be produced in quantity. The cost of too much memory for your application—or an unused CRT interface—can really mount up if you have to pay for them over and over again. The functional modularity of RM 65 modules lets you fine-tune your design to a precise balance of cost and performance features.



Fast response to changing requirements

Even the most finely-tuned designs can quickly go out of tune due to changed user requirements or the demands of the application. With a design based on RM 65 modules, you can respond to changed circumstances in short order.

For example, if your customers decide they want a disk storage capability that initially wasn't included, you can add it by just plugging in an RM 65 module. On the other hand, if competitive pressure results in your needing a product model with fewer "bells and whistles," to sell for a lower price, the RM 65's flexibility lets you redesign and get to market while demand is still strong. In brief, the RM 65 family lets you respond to a wide range of circumstances in a short span of time.



RM 65 modules: The simple solution in system design.

The microcomputer module

The simplest solution begins—and possibly ends—with the RM65-1000, a powerful, single-board computer based on the proven R6502 microprocessor.

Like all modules in the RM 65 family, this board is a compact 100 × 160 mm (3.9 × 6.3 in.), but it packs so many features on-board that it might meet your needs all by itself. If not, it becomes the foundation block for building your RM 65 system.

The RM65-1000(E) features:

- ☐ R6502 CPU
- ☐ 2K bytes of static RAM
- ☐ 16K bytes of PROM/ROM capacity
- ☐ R6522 Versatile Interface Adapter (VIA), with two 8-bit handshaking parallel ports, two 16-bit timer/counters, and 8-bit serial shift register

The system modules

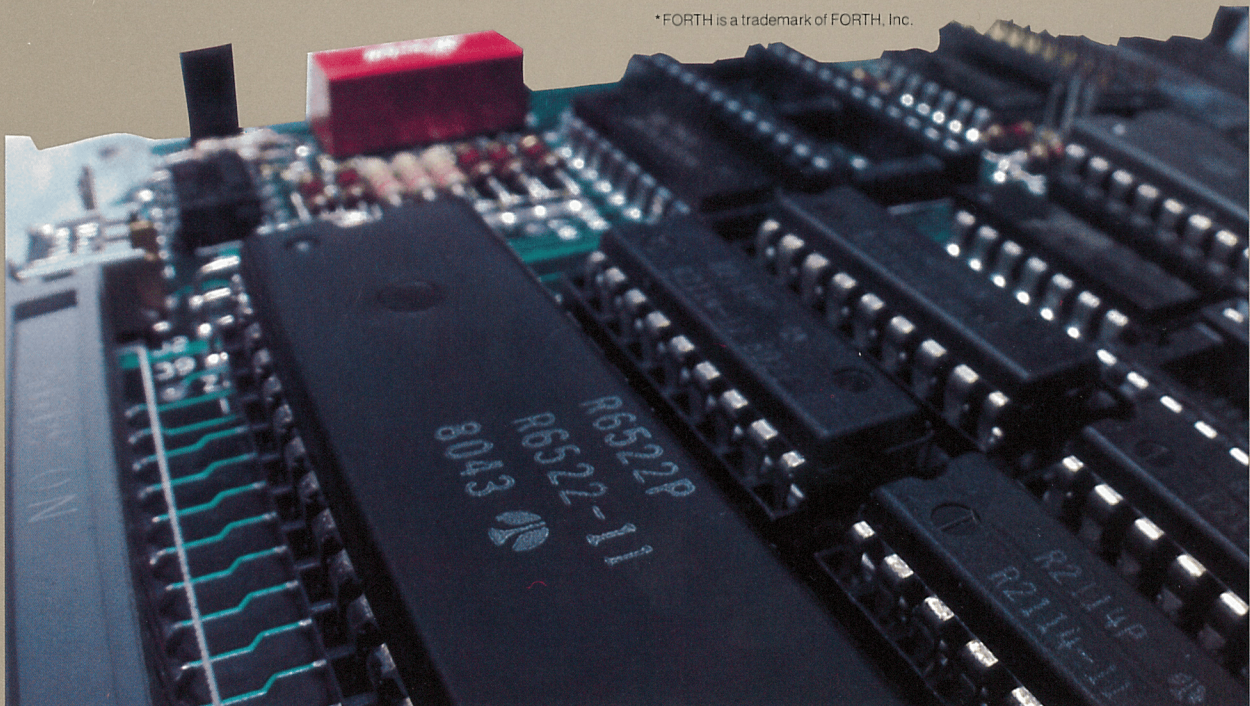
The array of modules in the RM 65 family is like that of a professional camera system: each category has elements of varying power and purpose, so you can snap together a well-fitted tool for each new job.

- ☐ **Memory.** Does your application call for a lot or a little? Static or dynamic? RAM or ROM? The on-board memory capacity of the RM 65 Single-

Board Computer might be enough for you. If not, just plug together the right combination from three kinds of add-on memory boards.

- ☐ **I/O.** Do you need parallel or serial? RS-232C or 20mA current loop? The RM65-1000's two on-board parallel ports plus a choice of add-on input/output modules offer plenty of options for device communication.
- ☐ **Peripherals.** Adding floppy disk storage, a CRT display or IEEE instrumentation peripherals to your RM 65 Microcomputer is just a matter of plugging in a module that includes driver software.
- ☐ **Accessories.** Card cages are available for plugging in 4, 8 or 16 boards. Other options provide for direct or remote connection to an AIM 65™ development system. All modules are available with standard edge connectors or Eurocard (DIN standard) pin and socket connectors.
- ☐ **Software.** BASIC and FORTH* run-time packages plug in as needed. Software control drivers are included in ROM on the intelligent peripheral modules.
- ☐ **The works.** The RM 65 family is rounded out with a choice of two development systems, including the low-cost AIM 65 Microcomputer—plus a prototyping module to plug your own custom circuits into the system, a full documentation library, and more. Rockwell has all the building blocks: you just put together the ones you need.

*FORTH is a trademark of FORTH, Inc.





RM 65 modules: The simple solution in memory options.

With built-in bank switching capability, the RM 65 Single-Board Computer can address up to 131,072 bytes of memory. Using plug-in modules of the same convenient size as the single-board computer, you can fill as much of the address space as your application requires. Add static RAM capacity in 8K increments, dynamic RAM capacity in 32K increments, and ROM capacity in 16K units for built-in programs. The RAM modules are available either with or without a full population of memory devices. Features of the memory modules in the RM 65 family include:

8K Static RAM Module, RM65-3108(E)

- ☐ Sixteen 2114 static RAM devices
- ☐ Two separately addressable blocks of 4,096 bytes
- ☐ Each block is switch-addressable to any 4K boundary
- ☐ Bank enabling and assignment are switch-selectable
- ☐ Only + 5 volt power supply required

8K Static RAM Module, RM65-3108N(E)

- ☐ Same as above, less RAM devices

32K Dynamic RAM Module, RM65-3132(E)

- ☐ Contains 32,768 bytes of dynamic RAM storage
- ☐ Invisible refresh maintains system performance
- ☐ Header-selected addresses for 4K blocks
- ☐ Switch-assignable to either 64K memory bank
- ☐ + 5 and + 12 V power supply required; - 5V generated on-board

32K Dynamic RAM Module, RM65-3132N(E)

- ☐ Same as above, less RAM devices
- ☐ Jumper wire selection for use with + 5 V only RAM devices

16K PROM/ROM Module, RM65-3216(E)

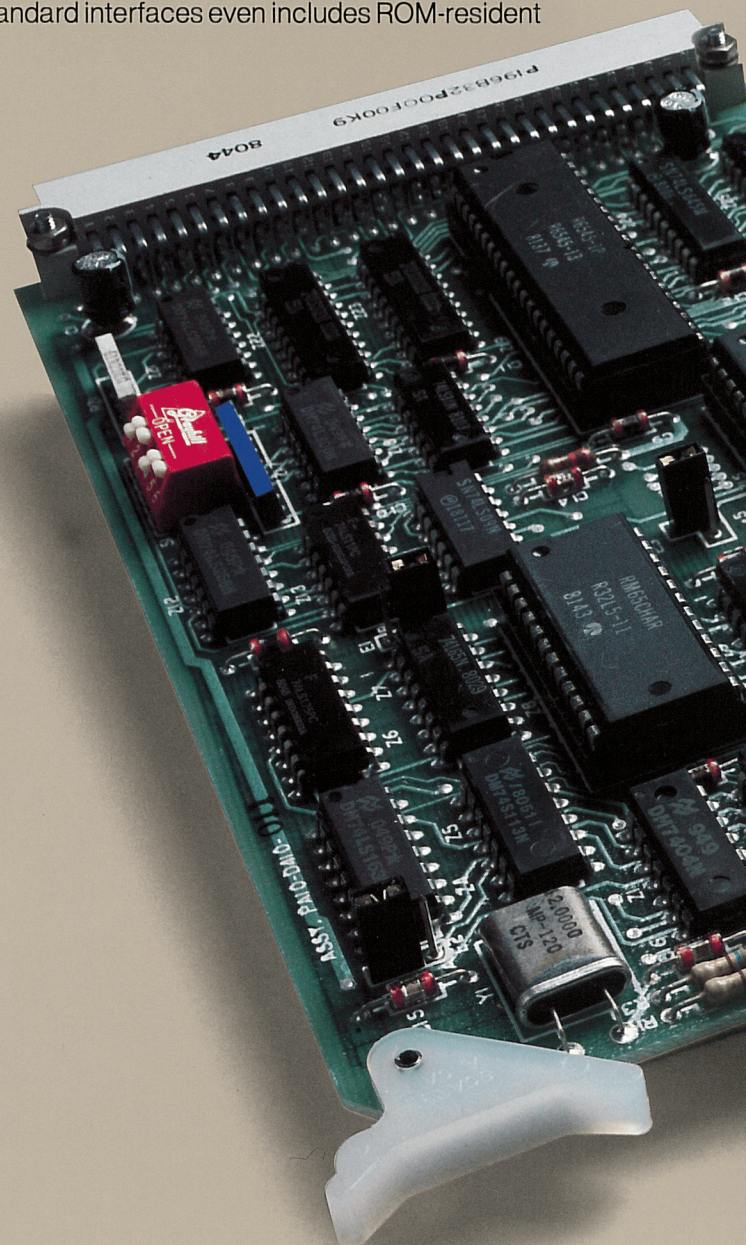
- Eight 24-pin sockets with on-board jumpers
- ☐ Used for stored-program ROMs and PROMs
- ☐ Accommodates 2K, 4K and 8K devices
- ☐ Address of each 4K block is switch-selectable
- ☐ Module is switch-assignable to either memory bank

- ☐ Accepts 450-nanosecond access-time devices
- ☐ Uses single + 5 V power supply

RM 65 modules: The simple solution in peripherals.

Five modules in the RM 65 family offer a full range of input/output and mass storage options. The Floppy Disk Controller (FDC) can handle up to four drives, either standard- or mini-size; one- or two-sided; single- or double-density. With the FDC, it's easy to add either a little mass storage or a lot.

If the on-board communications ports of the RM 65 Single-Board Computer don't meet your needs, you can add parallel and serial ports in most popular configurations. A controller board for IEEE-488 standard interfaces even includes ROM-resident



software. There is also built-in system software on the CRT Controller module. If your user interface would profit from an alphanumeric or limited graphic display, you can include it just by specifying this module and providing a video monitor for it to drive.

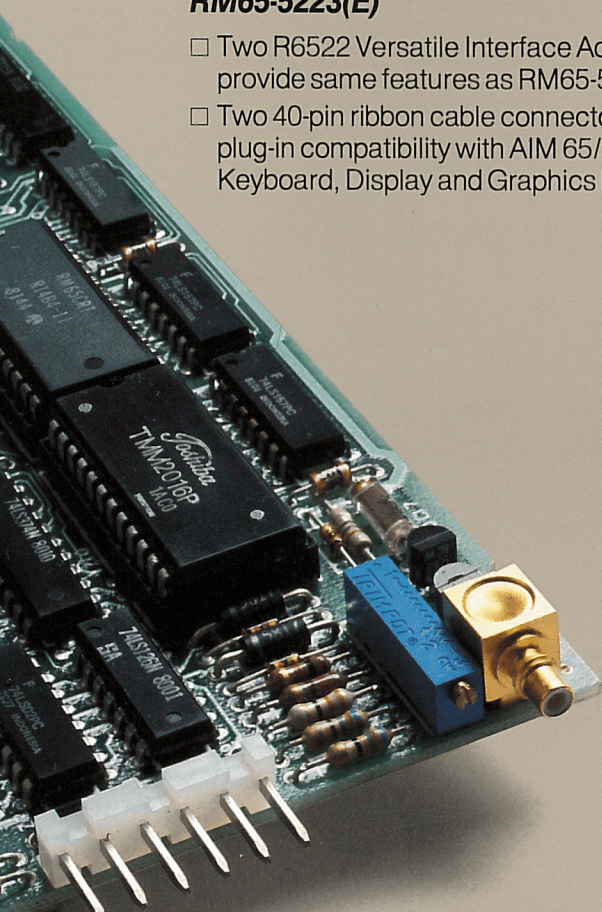
Plug together any combination of these modules to give your RM 65 microcomputer system all the power it needs.

General-Purpose Input/Output and Timer, RM65-5222(E)

- ☐ Adds two or more R6522 Versatile Interface Adapters to the one included on the CPU board
- ☐ Four 8-bit parallel ports each with two handshake lines, total of 40 buffered I/O lines
- ☐ Four 16-bit timer/counters
- ☐ Two 8-bit serial shift registers

Multi-Function Peripheral Interface, RM65-5223(E)

- ☐ Two R6522 Versatile Interface Adapter devices provide same features as RM65-5222(E), plus
- ☐ Two 40-pin ribbon cable connectors provide plug-in compatibility with AIM 65/40 peripherals, Keyboard, Display and Graphics Printer.



Asynchronous Communications Interface Adapter, RM65-5451(E)

- ☐ Controls two independent RS-232C serial ports, using R6551 devices
- ☐ Communication rates from 50 to 19,200 baud under software control
- ☐ Data set/data terminal handshake controls
- ☐ One port can be jumper-set for 20mA current loop for communication over longer distances

Asynchronous Communications Interface Adapter, RM65-5451N(E)

- ☐ Same as above, less + 5V to $\pm 12V$ DC/DC Converter

IEEE-488 Bus Controller, RM65-7102(E)

- ☐ Implements the IEEE-488 General-Purpose Interface Bus (1978 standard)
- ☐ Operates in talker, listener or controller modes
- ☐ Up to 15 peripherals can communicate with an RM 65 Microcomputer over this bus
- ☐ All IEEE-488 functions can be controlled easily through on-board driver software

CRT Controller, RM65-5102(E)

- ☐ Works with television receiver or CRT monitor; R6545-1 device provides timing and control
- ☐ Character generator for 5×7 dot characters in 7×10 field
- ☐ Character-level graphics included
- ☐ Peripheral driver software (in 2K ROM) built in
- ☐ 2K display refresh memory included
- ☐ Both composite video output and separate SYNC and video signals available

Floppy Disk Controller, RM65-5101(E)

- ☐ Use with one, two, three or four disk drives
- ☐ Controls both 8-in. and $5\frac{1}{4}$ -in. floppy drives
- ☐ Handles both single-sided and double-sided drives with either single- or double-density recording—including 96-TPI $5\frac{1}{4}$ -in. floppies
- ☐ Peripheral driver software (in 4K ROM) built in

Floppy Disk Controller, RM65-5101N(E)

- ☐ Same as above, less peripheral driver firmware

RM 65 modules: The simple solution in packaging.

Once you've designed your ideal microcomputer configuration with RM 65 modules, you can easily incorporate connectors for them into your product. All RM 65 boards are the convenient DIN standard size—100 mm × 160 mm (3.9 × 6.3 in.)—and can be ordered either with the highly reliable 64-pin DIN standard plugs, or with edge connectors for lower cost.

If you'd prefer to skip the work of interconnecting your modules, the RM 65 family offers you card cages in three convenient sizes. Here too, RM 65 helps minimize waste: by letting you choose the minimum package that brings your modules together as a working unit.

RM 65 Card Cage, RM65-7004(E)

- ☐ Four slots with integral module guides for easy insertion
- ☐ Edge- or pin-connector styles
- ☐ Power supplies connect to screw-down terminals

RM 65 Card Cage, RM65-7008(E)

- ☐ Same as above, but with 8 card slots

RM 65 Card Cage, RM65-7016(E)

- ☐ Same as above, but with 16 card slots

RM 65 modules: The simple solution combined with the AIM 65 Microcomputer.

For industrial applications requiring keyboard, display and printer functions, the AIM 65 Microcomputer can enhance RM 65 systems. In place of the RM 65 Single-Board Computer module, simply connect the AIM 65 Microcomputer to the RM 65 system, using one of the following adapters. (These are also useful for in-circuit evaluation of your RM 65 configuration when using the AIM 65 Microcomputer as a development system.)

Single-Card Adapter, RM65-7101(E)

- ☐ Attaches one RM 65 module to the AIM Microcomputer expansion connector
- ☐ Reroutes AIM 65 expansion connector signals for compatibility with the RM 65 bus

- ☐ Simplest expansion level using the AIM 65 Microcomputer

Adapter/Buffer Module, RM65-7104(E)

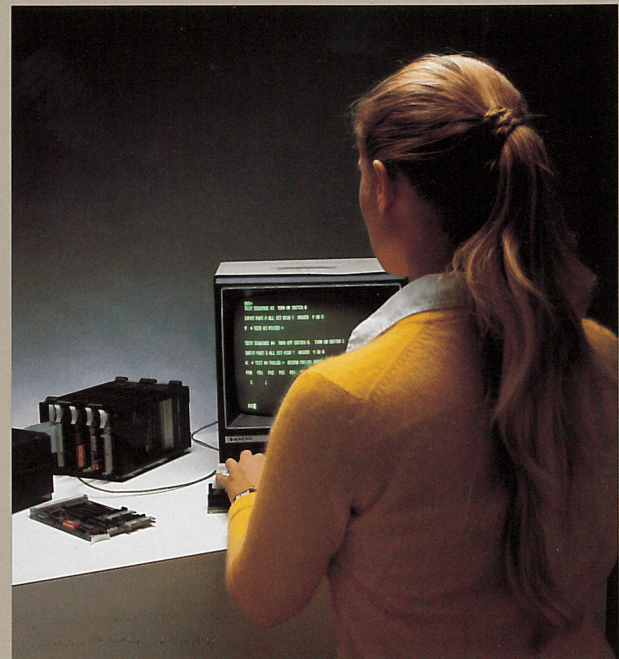
- ☐ Allows connection of AIM 65 Microcomputer to multiple RM 65 family modules
- ☐ Works like the single-card adapter, but links the AIM 65 Microcomputer to any RM 65 card cage
- ☐ Module uses one slot in the card cage; cross-connects all signals from the AIM 65 expansion connector except power and TEST

Cable Driver Adapter/Buffer, RM65-7116(E)

- ☐ Same as above, but with transceivers to drive a 6-foot cable connection between the AIM 65 Microcomputer and the card cage
- ☐ Useful for mounting support modules out of sight at a distance from the business end of an expanded RM 65 system using the AIM 65 Microcomputer

AIM 65/40 Adapter Cable and Buffer, RM65-7140(E)

- ☐ Allows attaching multiple RM 65 modules and card cage to AIM 65/40 Microcomputers
- ☐ Two meter cable attaches to the AIM 65/40 buffered expansion edge connector
- ☐ Buffer module inserts in card cage to drive up to 15 additional modules



RM 65 modules: The simple solution in plug-in software.

For applications lending themselves to implementation in a higher-level language, the RM 65 family includes plug-in ROMs with run-time packages for both BASIC and FORTH. Many RM 65 peripheral I/O modules also include on-board software drivers (but you have the option of interfacing directly with the programmable devices if you prefer). And through the systems described on the next page, you have access to powerful software development tools. RM 65 documentation includes the source code for many useful driver routines you can incorporate to speed development of your application.

Software packages in the RM 65 family include:

BASIC Run-Time Package, RM65-0122

- ☐ Allows interpretive execution of BASIC language programs
- ☐ Linkage provided for user-supplied peripheral drivers
- ☐ Directly compatible with Microsoft BASIC used for development on the Rockwell AIM 65 Microcomputer

FORTH Run-Time Package, RM65-0152

- ☐ Well suited to real-time industrial control applications
- ☐ Allows interpretive execution of FORTH programs
- ☐ Programmers can build on this kernel of structured, extensible, dictionary-style language

CRT Controller Software (ROM included on CRT module)

- ☐ Reduces software development for CRT driver and display control functions

- ☐ Simple subroutine calls select one of four screen formats for use with CRT/TV monitor
- ☐ Display control subroutines interpret commands for cursor movement, row-column positioning, scrolling, editing, inverted video, character- or limited-graphics mode, etc.
- ☐ Includes special routines for operation with AIM 65 software development features and programming languages

Floppy Disk Controller Software (ROM included on FDC module)

- ☐ Simplifies manipulation of mass storage media and file management
- ☐ Allows custom formatting of files and compatibility with existing file systems
- ☐ Driver provides elementary read, write, seek and related functions
- ☐ File-management routines are built in
- ☐ Format encoding is IBM compatible (Single density FM, Double density MFM)

IEEE-488 Software (ROM included on IEEE-488 module)

- ☐ Implements 1978 standard controller, talker and listener functions
- ☐ Subroutines allow polled, interrupt-driven, or DMA-controlled operation (if present)
- ☐ Over 60 subroutines in 16 categories offer a variety of operating modes, creation and manipulation of command/data tables, and self-test functions
- ☐ Extensive documentation includes flow charts and subroutine source listings



Creating an RM 65 simple solution with a choice of development systems.

A unique benefit available to RM 65 system builders is access to the low-cost Rockwell AIM 65 Microcomputer development system. This complete computer-on-a-board provides sophisticated software development tools at remarkably low cost. And if you need the full power of a traditional development system, Rockwell's SYSTEM 65 will fill the bill.

Development using the AIM 65 Microcomputer

Judged by the amount of work it can do for a very small price, the AIM 65 Microcomputer is a powerhouse. It includes built-in keyboard, 20-column alphanumeric display and printer, and interfaces for audio tape cassette storage and Teletypewriter. Available software tools include development versions of the RM 65 BASIC and FORTH run-time packages, plus the following:

- ☐ Monitor/Debugger
- ☐ Mnemonic Assembler
- ☐ Disassembler
- ☐ Text Editor

- ☐ 2-pass Symbolic Assembler
- ☐ PL/65 Compiler

Final code developed on the AIM 65 Microcomputer can be transferred to PROMs with the PROM Programmer and CO-ED module, available as an attachment. The AIM 65 Microcomputer can also emulate the RM 65 Single-Board Computer for in-circuit testing applications.

Development using SYSTEM 65

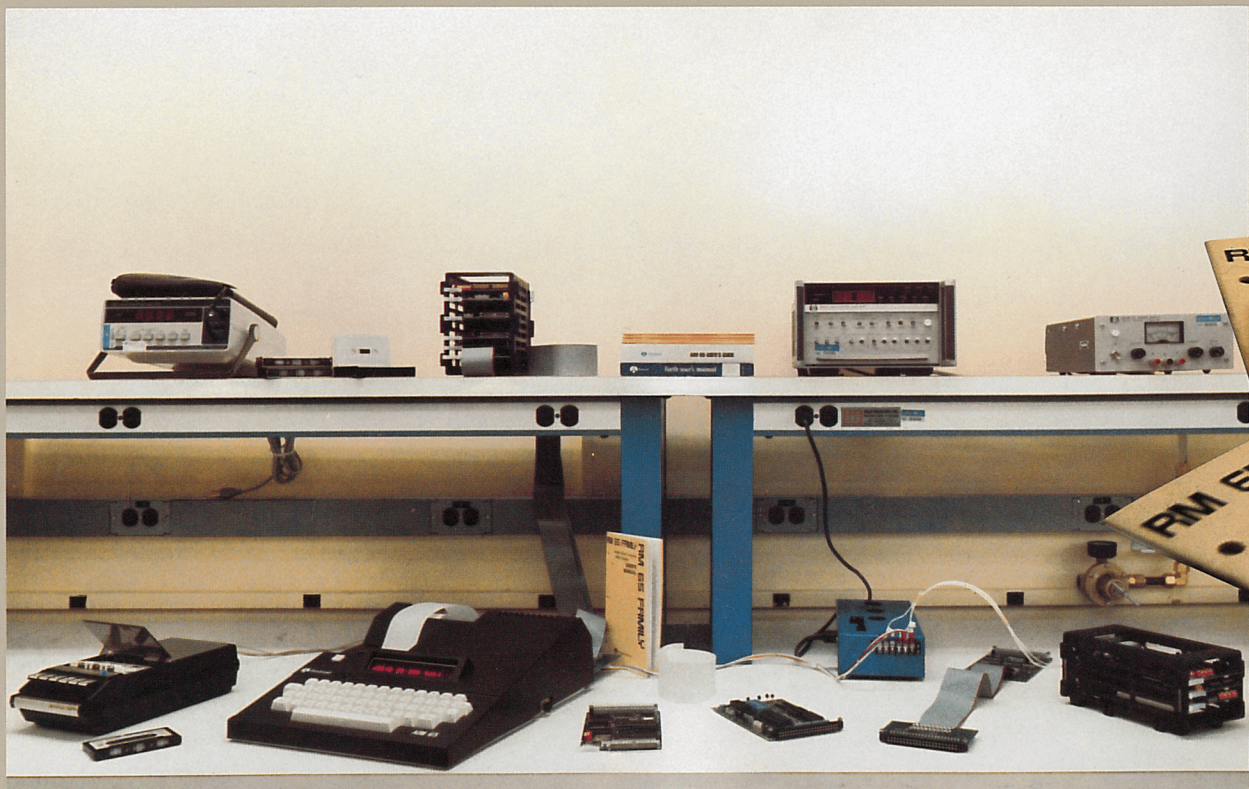
Intensive program development efforts will probably find that the extra power of this full-scale development system justifies its extra cost.

The SYSTEM 65 includes:

- ☐ Dual 5 1/4 -in. floppy disk drives
- ☐ RS-232C serial interface for CRT terminals
- ☐ Parallel interface for high-speed printers
- ☐ Monitor/Debugger, Text Editor and Assembler in ROM
- ☐ Disk-based Macro-assembler and Linking Editor for large programs

Available options for the SYSTEM 65 include:

- ☐ In-circuit evaluation module for RM 65 systems
- ☐ SYSTEM 65 PROM programmer
- ☐ PL/65 compiler



Refining an RM 65 simple solution with custom circuits.

No matter how big the RM 65 family gets, there will still be times when only a circuit of your own design can provide a complete solution.

To accommodate this need, the RM 65 family includes a prototyping module for developing your hardware designs and easily interfacing them to the rest of your RM 65 configuration.

Design Prototyping Module, RM 65-7201(E)

- ☐ Standard RM 65 card and connector
- ☐ Power and return lines prerouted
- ☐ Plated-through hole pattern for manual or automatic wire wrapping

Extender Module, RM65-7211(E)

- ☐ Positions RM 65 module outside the card cage for troubleshooting
- ☐ Maintains electrical continuity with the RM 65 bus while tracing signals

Self-Test Software

- ☐ Modules that incorporate Rockwell-supplied software include routines to perform limited self-testing

Completing an RM 65 solution with documentation and applications information.

For each individual RM 65 module, Rockwell furnishes a User's Manual, which includes a functional description, jumper and switch selection, and schematic. Manuals for the intelligent peripheral I/O modules include the source code listing and subroutine call information.

The intelligent device is an increasingly irresistible phenomenon. The imperatives driving it are ever-growing demands for productivity, energy conservation and innovation. Both the general economy and individual manufacturers will profit from the growth of intelligent products and devices. But those who profit most will be the ones who find the simplest solution to building-in electronic intelligence.

For that solution, there is no better set of building blocks than the Rockwell RM 65 family of modular microcomputer products. For more information on how the RM 65 family can provide a simple solution to *your* need, call or write the Electronic Devices Division of Rockwell International at the addresses shown on the back of this brochure.



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